

## **The Ticket To Retention: A Classroom Assessment Technique Designed To Improve Student Learning**

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### **Abstract**

Classroom assessment techniques (CATs) or other closure activities are widely promoted for use in college classrooms. However, research on whether CATs improve student learning are mixed. The authors posit that the results are mixed because CATs were designed to “help teachers find out what students are learning in the classroom and how well students are learning it” (Anglo & Cross, 1993, p.4) rather than to help students learn the material. Thus, in order for CATs to be effective for helping students learn, they should be redesigned to focus on student retention of concepts. The Ticket to Retention 2 (TtR2) is designed to do just that.

**Keywords:** Classroom assessment techniques, student learning, concept retention.

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The Ticket to Retention (TtR) was designed to increase student retention of concepts. The TtR is similar to classroom assessment techniques (CATs) because it involves students in writing about information covered during a class session, can be used to assess student understanding of concepts, and helps to determine if the professor’s teaching methodology was successful in conveying information to the students (Angelo & Cross, 1993; Cross & Angelo, 1988; Barkley, Cross, & Major, 2005; Weaver & Cotrell, 1985). CATs or other closure activities are widely promoted for use in college classrooms (Angelo & Cross, 1993; Barkley, 2010; Blumberg, 2009; Cross, 1998; Cross & Angelo, 1988; McGlynn, 2001; Nilson, 2010; Richlin, 1998; Richlin, 2006; Steadman & Svinicki, 1998; Weaver & Cotrell, 1985; Wlodkowski, 2008). Anglo and Cross (1993) state that “Classroom Assessment is an approach designed to help teachers find out what students are learning in the classroom and how well students are learning it” (p. 4).

However, the TtR was designed to do more. The original TtR combined “the benefits of the ticket to leave, the one minute paper, half-sheet response, the post-write strategy, and think-pair-share strategies” (Divoll & Browning, 2010). Although the TtR and other CATs are similar, the TtR differs because it is designed to use three to five focused questions and peer interaction to increase students’ retention. Research on CATs found increased student satisfaction when such strategies are used (Cottell, 1991; Anglo & Cross, 1993; Olmstead, 1991; Walker, 1991); however, the effect of CATs on student learning has interpreted as mixed (Anglo & Cross, 1993) and lacking evidence (Simpson-Beck,

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2011). For example, Shelton (1991) and Walker (1991) found that student learning is increased with the use of classroom assessment, but Cottell and Hardwood (1998), Kelly (1991), Olmstead (1991), Simpson-Beck (2011), and Stetson (1991) found no evidence of increased learning. In addition, much of the research on CATs effect on learning comes from student survey data (i.e., Byon, 2005; Goldstein, 2007; Fabry, Eisenbach, Curry, & Golich, 1997; Kelly, 1991; Rouseff-Baker & Holm, 2004; Soetaert, 1998; Steadman, 1998). The goal of designing the TtR and the Ticket to Retention 2 (TtR2) was to create a CAT that could result in the same benefits for professors (i.e. evaluating teaching, determining student's understanding of concepts, and increased students' satisfaction with a course) (Cottell, 1991; Anglo & Cross, 1993; Olmstead, 1991; Walker, 1991), but also increase student learning.

In earlier research, the TtR was used to reinforce concepts, and students retained approximately 88% of the information that that was reviewed with the TtR (Divoll & Browning, 2010; Divoll, Browning, & Vesey, 2012). Despite these benefits, students who used the TtR seemed to score about the same on multiple choice questions at the end of the semester as their peers who did not use the TtR, whereas students who used the TtR scored much higher on short answer questions at the midpoint of the semester than their peers (Divoll & Browning, 2010; Divoll, Browning, & Vesey, 2012).

The original TtR was basically rote rehearsal since students were simply reviewing the information multiple times in a short amount of time, therefore the rote rehearsal strategy may not lead to increased retention (Sousa, 2001). Considering the literature on learning theory, recommendations from students who used the TtR, and in an attempt to improve student retention from results of the original TtR, the ticket to retention was redesigned into the TtR2. The TtR2 has students taking notes on the TtR2 sheets during class rather than only writing their answer at the end of class. Since highlighting key points during class helps students understand what is important and helps students learn (Bransford, Brown, & Cockering, 2000; Davis, 2009), the TtR2 includes the professor alerting the students to the key points during instruction and encourages students to write the answer to the questions on the TtR2 sheet when the information is discussed.

After being alerted to the important points and writing the answers during class, social interaction occurs when students discuss their answers with two other students (one at a time). Situating learning in a social context has been shown to result in increased learning (Kafai & Resnick, 1996) and is recommended when teaching adults (Blumberg, 2009; Bransford, et. al., 2000; Davis, 2009; Donovan, Bransford, & Pellegrino, 1999; Johnson, Johnson, & Smith 1998; Richlin, 2006; Lawler, 1991). The TtR2 also added an aspect of higher level thinking into the original TtR, i.e., comparing and contrasting, which is absent in the original version. In the TtR2, the students compare and contract their answers to the questions with that of their peers and include ideas that were discussed during the peer interaction if the peer's answer added to their answer. The assumption is that by including aspects of higher level thinking, which is at the analysis level of Bloom's taxonomy (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) and one of McKeachie's (2002) categories for challenging questions, the TtR2 would further increase student retention.

Students conclude their discussion of the topics by writing the best possible answer, which is also something that is unique to the TtR2.

The TtR2 is designed to improve students' retention of concepts. Learning and retention are not the same (Sousa, 2001). Retention is defined as "the process whereby long-term memory preserves a learning in such a way that it can locate, identify, and retrieve it accurately in the future" (Sousa, 2001, p. 85). Barkley (2010) states, "Retention is influenced by many factors, but a critical one is adequate time to process and reprocess information so that it can be transferred from short-term to long-term memory" (p. 23). The TtR2 attempts to create adequate time using the strategy throughout the entire class session and reprocessing by using multiple-sense and multiple-method instruction, which results in students learning "better and more" (Nilson, 2010, p.237).

Having students listen, write, say, and compare/ contrast the concepts results in students interacting with the ideas "multiple times and in different ways" (Nilson, 2010, p.237). Diversification in learning activities improves learning by involving multiple parts of the brain (Kress, Jewitt, Ogborn, & Charalampous, 2006; Verkiri, 2002). The TtR2 also provides students with the feedback, practice, and review needed for students to retain information (Bransford et al., 2000; Davis, 2009; Donovan et al., 1999), and allows students to reexamine concepts (Cross, 1981).

As is learner-centered teaching, the focus of the TtR2 is to shift the role of professors from provider of knowledge to facilitators of learning (Barr & Tagg, 1995; Blumberg, 2009; Wlodkowski, 2008) and to concentrate more on student learning (Blumberg, 2009; DeZure, 2000; Fink, 2003; Gardiner, 1994; Weimer, 2002). Although this shift seems logical to many, it is not the norm in the lecture-dominated college classroom (Bligh, 2000; Lammers & Murphy, 2002). However, the shift in teaching strategies should occur since millennial students "want to know we care about them" (Nilson, 2010, p.12). The TtR2 also includes active learning in the classroom, which can result in improved student learning and is recommended at the college level (Flint, Zakos, & Frey, 2002; Ginsberg, 2010; Ginsberg & Wlodkowski, 2009; Grubb, 1999; Grubb & Byrd, 1999; Hackathorn, Solomon, Blankmeyer, Tennial, & Garczynski, 2011; Kuh, Kinzie, Schuh, Whitt, & Associates, 2005; McGlynn, 2001; Meyers & Jones, 1993; Sorcinelli, 1991; Wlodkowski, 2008; Woolfolk, 2011).

Research on the TtR was based on using an assessment at the midpoint of the semester and at the end of the semester to determine if using the TtR resulted in higher scores (Divoll & Browning, 2010; Divoll, Browning, & Vesey, 2012). However, a limitation to the earlier research was that students were not given a pretest at the beginning of the semester to determine what the students knew going into the semester. This study adds to the growing body of literature on the TtR and TtR2 by using a pretest to determine how much students knew at the beginning of the semester and the impact of the TtR2 on students' retention of concepts. In addition, this study provides further evidence that CATs can be enhanced to improve student retention.

## Methodology

Seventy undergraduate students in three sections of an education course participated in this mixed methods study. The setting included two four-week summer courses and one 15-week fall undergraduate college level classroom management course at a southern university. Professor A taught one section of the course in the summer (section one) and one in the fall summer (section three). Professor B taught one course in the summer (section two). The professors, who are the authors of this paper, created the TtR2. The two four-week summer semester included 15 two-hour 50 minute sessions Monday through Thursday and the 15-week fall semester included meeting weekly for two hours and 50 minutes.

In each course, the students were divided into two groups, a group of students who received the TtR2 the first half of the semester (group A) and a group of students who received the TtR2 the second half of the semester (group B). Students were assigned to the groups randomly. The group not using the TtR2 for the week left class 10 minutes early, while the TtR2 group stayed to complete the TtR2. Group A participated in the TtR2 in classes 2-6. Both groups A and B participated in the TtR2 in class seven due to an odd number of classes in which the TtR2 was implemented. During class seven, a midpoint retention assessment (MRA), which consisted of short answer questions, was administered to determine the information retained by group A and group B. The TtR2 for class seven was conducted the same week as the MRA, but after the assessment for the first part of the semester was administered. In addition to week seven, group B participated in the TtR2 in classes 8, 9, 11, 12, and 13. Therefore, when the MRA was administered, group A was tested on the material that was reinforced using the TtR2, while group B was tested on the same material, but had not been given the TtR2 to reinforce the concepts.

A comprehensive retention assessment (CRA) was administered during class 15 and included 49 multiple choice questions testing students' recall of the information from the entire semester. Questions 1-22 were from classes 2-6, questions 23-27 were from class 7, and questions 28-49 were from classes 8, 9, 11, 12, and 13. Thus, questions 1-27 represented times when group A used the TtR2 and questions 23-49 represented times when group B used the TtR2.

### ***Data Collection and Analysis***

Data collection methods included: (a) a pretest, (b) the MRA, (c) the CRA, and (d) a student questionnaire about the TtR2. The pretest, which was administered the first class, was comprised of 49 multiple choice questions and assessed the students' knowledge of the major concepts for the semester. The MRA and the CRA assessed only concepts that were included on the TtR2. The MRA was administered on the seventh week, while the CRA and student questionnaire were conducted during the final class (the fifteenth class). Each of the assessments was used to determine students' retention of concepts taught and did not count as a grade. Thus, students were not given advanced notice of the MRA and CRA.

The pretest and assessment data were analyzed by assessment types and sections. The pretest results were compared to the MRA and CRA when the TtR2 was implemented and when it was not. These comparisons resulted in the creation of a change score (i.e., MRA minus the pretest or CRA minus the pretest) with the intervention and one without (the difference between the pretest and an assessment). The mean and standard deviation were generated for each data set. Overall, the average of all of the sections were generated for the pretest, MRA, CRA, and change score. In addition, an overall average for each of the aforementioned data was generated when the intervention was implemented and again when it was not. Each calculation was rounded to the nearest tenth.

The Mann-Whitney U statistic and the Wilcoxon statistic were used to determine if the distribution of scores for the individual sections significantly differed. However, these tests could not be run for the averages of all three sections because of the different variables (professor and semester length). These tests could not be run to determine if the CRA and pretest with and without the TtR2 significantly differed because the students from groups A and B used the TtR2 with different questions (i.e., 1-27 for group A and 23-49 for group B).

In addition to the students' retention assessments, the students were asked their views about the TtR2. The students were asked three open ended questions about the TtR2 (68 out of the 70 students complete the questionnaire; a 97% response rate): (a) did you learn more as a result of the TtR2, (b) would you use the TtR2 in your future classroom, and (c) general comments about the TtR2. The questionnaire data was analyzed by question topic using open coding to create categories and patterns. In accordance with qualitative methodology, after the categories and patterns were generated, a constant comparative approach resulted in discovering evidence for the categories and patterns across the questions and axial coding was applied to each data source to make connections between the categories and patterns (Creswell, 1998; Rossman & Rallis, 2003). Rather than share each students' comments for each pattern, the students' comments are either summarized or only a few examples are given.

## Results

Quantitative data were organized by assessment (MRA, CRA, and pretest), change score, section, and finally a summary of the assessments across the sections was discussed. The qualitative data were organized by themes that emerged across all of the sections. The questions on the MRA corresponded to questions 1-22 on the pretest and CRA. Questions one through 22 were the concepts for which only group A used the TtR2 on the CRA, questions 28-49 were concepts that only group B used the TtR2, and questions 23 through 27 were concepts for which the TtR2 was used by both groups. The aforementioned questions on the CRA correspond to the same questions on the pretest.

### **Pretest Scores**

Sections one, two, and three averaged 68 ( $n = 27$ ), 60 ( $n = 26$ ), and 64 ( $n = 17$ ), respectively, on the pretest (see Table 1). The pretest average across all sections was 64 (see

Table 2) with group A scoring 64 and group B averaging 64.1. Scores for groups A and B on the information that they were to use the TtR2 was 62.2 with the TtR2 and 66.2 without. The pretest average for questions one through 22 was 61.5, questions 23 through 27 averaged 44, and questions 28-49 averaged 71.6. The Mann-Whitney *U* was conducted for each class to determine if the distribution of scores on the Pretest for questions 1-22 and questions 28-49 significantly differed between groups (group A and B). The results of the Mann-Whitney *U* for sections one, two, and three indicated no significant difference between groups for questions 1-22 and 28-49 (see Tables 3, 4, and 5). Thus, students in group A performed about the same on the pretest for questions 1-22 and 28-49. The data for questions 23-27 was not run for any of the sections because both groups used the TtR2 for these questions.

### **MRA Results**

Sections one, two, and three averaged 84.6 ( $n = 14$ ), 84.3 ( $n = 13$ ), and 81.6 ( $n = 8$ ), respectively (see Table 1), on the MRA with the TtR2 and 67.87 ( $n=13$ ), 69.3 ( $n = 13$ ), 66.4 ( $n = 9$ ) without the TtR2. The MRA average for all three sections when the TtR2 was used was 83.8 and 68 when it was not (15.8 point difference) (see Table 1). The Mann-Whitney *U* was conducted for each class to determine if the distribution of scores

**Table 1. Section Averages.**

<b>Assessment</b>	<b>Sections</b>					
	<b>1</b>	<b>SD</b>	<b>2</b>	<b>SD</b>	<b>3</b>	<b>SD</b>
Pretest	68.0%	9.35	60.0%	6.91	64.0%	8.78
Pretest Group A	69.2%	9.21	58.2%	7.34	64.0%	7.79
Pretest Group B	66.6%	9.66	61.7%	6.24	64.0%	10.05
Pretest with TtR2	66.8%	12.64	56.4%	7.86	63.8%	11.75
Pretest without TtR2	69.0%	14.87	64.7%	12.08	63.9%	12.20
Pretest Q1-22	59.1%	10.09	66.8%	9.60	57.2%	12.56
Pretest Q23-27	68.9%	16.01	7.7%	11.42	60.0%	18.71
Pretest Q28-49	76.3%	13.48	67.1%	20.63	71.1%	10.53
MRA	76.5%	13.37	76.8%	12.78	75.9%	16.00
MRA with TtR2	84.6%	9.35	84.3%	11.35	81.6%	4.62
MRA without TtR2	67.8%	11.54	69.3%	9.46	66.4%	19.29
MRA Change Score with TtR2	25.6%	7.26	26.1%	10.67	24.2%	13.49
MRA Change Score without TtR2	8.7%	11.18	7.6%	11.55	9.4%	17.42
CRA	88.0%	8.24	81.2%	6.46	84.4%	7.72
CRA with TtR2	88.3%	8.88	85.5%	7.48	81.7%	8.43
CRA without TtR2	87.2%	10.63	79.6%	8.46	80.8%	7.62
CRA Change Score with TtR2	21.5%	8.90	29.1%	10.56	17.9%	12.91
CRA Change Score without TtR2	18.2%	13.40	14.8%	10.25	16.6%	13.61

**Table 2. Overall Averages: Sections.**

<b>Assessment</b>	<b>Mean</b>	<b>With TtR2</b>	<b>Without TtR2</b>	<b>Difference</b>
Pretest	64.0%	62.2%	66.2%	-4.0%
Pretest Group A	64.0%	X	X	X
Pretest Group B	64.2%	X	X	X
MRA	75.9%	83.8%	68.0%	15.8%
MRA Change Score	17.0%	25.4%	8.5%	17.0%
CRA	84.4%	85.7%	82.8%	2.9%
CRA Change Score	20.5%	23.4%	16.6%	6.8%

on the MRA significantly differed between groups (i.e., with TtR2 vs. without TtR2) (see Tables 3, 4, and 5). The results for students in group A, the group who received TtR2 during weeks 2 – 6, scored significantly higher on the MRA than students who did not receive the TtR2 in sections one and two. Despite the 15.1 point difference between groups A and B, the results of the Mann-Whitney *U* for section three indicated no significant difference between groups.

### ***CRA Results***

Students across the sections averaged an 84.4 on the CRA (see Table 2). The CRA average for all three sections when the TtR2 was used was 85.7 and 82.8 without the TtR2. Sections one, two, and three averaged 88.3, 85.5, and 81.7, respectively, on the CRA with the TtR2 and 87.2, 79.6, and 80.8 without the TtR2 (see Table 1).

### ***Change Scores***

The pretest was compared to the MRA and CRA to determine what the students retained during the course. The difference between the pretest and the two assessments show what the students knew at the beginning of the semester and what knowledge they retained at the middle of the semester (MRA change score) and at the end of the semester from the course (CRA change score). We refer to the difference between the pretest and the MRA and CRA as a change score.

***MRA change score.*** Across all three sections students who used the TtR2 on the MRA had a change score of 25.4 points, while students who did not use the TtR2 had a change score of 8.5 points (see Table 2). This resulted in the students who used the TtR2 having a change score that was 17 points higher than their peers. The MRA change scores for sections one, two, and three averaged 25.6 points, 26.1 points, and 24.2 points, respectively, with the TtR2 and 8.7 points, 7.6 points, and 9.4 points without the TtR2. The Mann-Whitney *U* was conducted for each class to determine if the distribution of MRA change scores significantly differed between groups (i.e., with TtR2 vs. without TtR2)

**Table 3. Statistical Analysis.**

Comparison	Results	Statistics	P value
Pretest Q1-Q22 (TtR2 vs. no TtR2)	NS	Mann Whitney U	$z = -.418, p = .676$
Pretest Q28-Q49 (TtR2 vs. no TtR2)	NS	Mann Whitney U	$z = -.984, p = .325$
MRA (TtR2 vs. no TtR2)	S	Mann Whitney U	$z = -3.283, p = .001$
MRA CS (TtR2 vs. no TtR2)	S	Mann Whitney U	$z = -3.786, p < .001$
CRA CS (TtR2 vs. no TtR2)	NS	Wilcoxon	$z = -1.057, p = .290$

Note. "NS" indicates that the results are non-significant, while "S" indicates significant.

**Table 4. Section 2 Statistical Analysis.**

Comparison	Results	Statistics	P value
Pretest Q1-Q22 (TtR2 vs. no TtR2)	NS	Mann Whitney U	$z = -1.722, p = .085$
Pretest Q28-Q49 (TtR2 vs. no TtR2)	NS	Mann Whitney U	$z = -1.142, p = .253$
MRA (TtR2 vs. no TtR2)	S	Mann Whitney U	$z = -3.214, p = .001$
MRA CS (TtR2 vs. no TtR2)	S	Mann Whitney U	$z = -3.181, p = .001$
CRA CS (TtR2 vs. no TtR2)	S	Wilcoxon	$z = -3.645, p < .001$

Note. "NS" indicates that the results are non-significant, while "S" indicates significant.

(see Tables 3, 4, and 5). The results for section one and two indicated that there was a significant difference between groups. Thus, students in group A, the group who received TtR2 during weeks 2 – 6, had significantly higher MRA change scores than students who did not receive the TtR2. Despite the 14.8 point change score for section three the results of the Mann-Whitney *U* indicated that the groups scored about the same.

**CRA change score.** Across all three classes students who used the TtR2 on the CRA had a change score of 23.4 points, while students who did not use the TtR2 had a change score of 16.6 points (see Table 2). This resulted in the students who used the TtR2 having a change score that was 6.8 points higher than their peers. The CRA change scores for sections one, two, and three averaged 21.5 points, 29.10 points, and 17.9 points, respectively, with the TtR2 and 18.2 points, 14.9 points, and 16.8 points without the TtR2 (see Table 1). The Wilcoxon statistic was conducted to determine if the distribution of CRA change scores was significantly differed between groups (i.e., with TtR2 vs. without TtR2) (see Table 3, 4, 5). Students in group A, the group who received TtR2 during the first part of the semester performed about the same on their CRA change scores as students who did not receive the TtR2 in both sections one and three. The results from section two indicated that there was a significant difference between the two groups.

**Table 5. Section 3 Statistical Analysis.**

Comparison	Results	Statistics	P value
Pretest Q1-Q22 (TtR2 vs. no TtR2)	NS	Mann Whitney U	$z = -.097, p = .923$
Pretest Q28-Q49 (TtR2 vs. no TtR2)	NS	Mann Whitney U	$z = -.537, p = .606$
MRA (TtR2 vs. no TtR2)	NS	Mann Whitney U	$z = -1.742, p = .082$
MRA CS (TtR2 vs. no TtR2)	NS	Mann Whitney U	$z = -1.78, p = .075$
CRA CS (TtR2 vs. no TtR2)	NS	Wilcoxon	$z = -.166, p = .868$

Note. "NS" indicates that the results are non-significant, while "S" indicates significant.

### ***Student Questionnaire Data***

In addition to the students' retention assessments, the students were asked their views about the TtR2. The students were asked three open ended questions about the TtR2.

***Using the TtR2 in their future classroom.*** Thirty-four of the 68 students (50%) suggested that they would use the TtR2 in their future classrooms. Most of these 34 students, suggested that they would use the TtR2 in their future classroom because they believed their students would benefit from the TtR2. Examples of these responses included: (a) "It offers the students with another opportunity to hear and discuss the material and is a great closing for the lesson" (S2-10B) and (b) "Yes, if the ticket to retention worked for me and many of the other students (I heard) it will most likely work with children rather than just lecturing" (S2-17B). In addition, one of the students suggested that the TtR2 is a good strategy for non-native English speakers, "Yes, I would like to use the ticket to retention because as a second language learner, I learned a lot from the material and I think this strategy will help others students that are learning English to become success in class" (S3-15B).

Twenty-four of the students (35%) indicated they may use the TtR2 in their future classroom. Of the 24 students who suggested they may use the TtR2, ten students mentioned that their decision was dependent on the age of students that they taught. Seven of the students who suggested that they may use the TtR2 in their classroom indicated that they might make changes to the TtR2 before using the strategy. These students suggested that they would either use an aspect of the TtR2: "I might use part of it such as talking to a partner about one aspect of the lesson" (S2-22B) or diversify the TtR2: "Possibly for some topics and in some forms, but I will probably change it up a little to give some variety (S1-5B).

Ten of the students (15%) indicated that they would not use the TtR2 in their classrooms. Of these students, four suggested that they would not use the TtR2 because they believed the TtR2 would not work for the age that they were teaching. The remaining six students mentioned that they would not use the TtR2 because they either did not see the value in it, they did not enjoy it and thus would not use the strategy in their classroom, or they would rather use other strategies.

**Students' perception of the TtR2 on their learning.** Forty-three of the students (or 63.2%) stated that the TtR2 had a positive impact on their learning. For example, the students suggested that the TtR2 helped them remember difficult concepts, being more confident with the information and recalling information quicker.

Student S3-13B inferred that the TtR2 was more helpful than simply taking notes, "Yes, because even though I usually took notes it is not the same when you hear the answers twice and then rewrite them." Another student indicated that the TtR2 resulted in learning the vocabulary better, "I do feel like I remembered more vocabulary from the parts that I did the ticket. I normally do not remember vocabulary" (S1-22B). The TtR2 seems to encourage students who might not take notes to do so, "I knew all the questions that I did with the ticket to retention and the other questions I wasn't 100% sure on because I listened in class but I didn't always take notes" (S1-10A). In addition, a student who had the ticket the second part of the semester felt lost on the MRA because they did not use the TtR2,

When I did the ticket to retention it helped me to understand better about the subject or material that the teacher was teaching. Also, doing the "final exam" I was more secure about the materials that I learn during the semester. When I took the "midterm exam" I was a little lost because I did not have something that can help me to reinforce the material that I was learning at the beginning of the semester (S3-17B).

Finally, student S1-9A posited that the TtR2 made him more aware of what the professor's focus was, "I was in the first group of ticket to retention and it made me more aware of what the instructor was focusing on, and because I did the ticket of retention I felt comfortable in taking notes afterward."

Twenty-three of the students (33.8%) believed that the TtR2 had little or no impact on their ability to recall the information on the CRA. A theme that emerged from the students who believed that the TtR2 resulted in little or no impact on their retention was that the use of other teaching strategies negated the potential impact of the TtR2. Students believed that the other class strategies (i.e., discussion and active learning strategies) were just as effective as the TtR2: "I'm an auditory kinesthetic learner and with the interactive environment of the class I was able to retain pretty well... It all seemed about the same to me. The actual hands on is what helped me retain most of the information" (S1-5B). Student S3-16B, in addition to feeling that other strategies help her in class also expressed that she became anxious as a result of doing the TtR2, "I feel that I learned more when we worked together with a group... I think the TtR2 gave me anxiety more than anything because I would have to rush at the end of class to get it finished."

Five of the students who felt the TtR2 had little or no impact on their recall indicated that their own abilities as students helped them more than the TtR2. Student S2-7A mentioned that her interest in the subject was a factor in the TtR2 not resulting in improved learning, "I feel I remembered close to the same, because I was genuinely interested in the materi-

al.” Studying outside of the classroom was another factor why students did not see the TtR2 as something that helped them,

I paid attention no matter if I had the ticket or not. And when I am trying to remember something I have to go over many times - talking, hearing, and writing about it so going over it one time after the lecture doesn't really help me. (S3-6A)

Another student stated that because she was an overachiever she learned regardless of the TtR2, “Coming from the overachiever, I find that the CRA was very easy for me because I paid attention for the whole class and remembered everything, so to be honest, I am not sure if the ticket actually helped” (S1-24B). Finally, one student suggested that she can learn without the TtR2 because of the type of learner she is, “I think it was about the same. I guess because of my type of learning is why I can retain different things” (A1-8B). Three students suggested that the reason the TtR2 did not result in more recall was because they did the TtR2 during the first part of the year. For example, student S1- 27B rationalized that timing of using the TtR2 was relative to their recall, “The first part of the CRA was from the MRA and I only felt unsure about a couple, but I think it was because the information was older - not because of the ticket” (S1-19B).

***Recommendations for the TtR2.*** Five students suggested that the TtR2 could be improved by starting the ticket to retention earlier so that students would not have to rush. One interesting theme that emerged from the data was that the TtR2 was best suited for weaker students. One student mentioned that the TtR2 is only good for some learners, “Ticket to retention is good for some learners, but also not good for others” (S1-3A). Students S2-7B suggested that the TtR2 would help students who are not interested in the topic, “I think for those who did not have an interest in the topic it may have helped a lot for them.” Furthermore, student S3-12B indicated that the TtR2 would be assist students if they did not know how to take notes, “Ticket to retention is a great strategy for helping students learn how to take notes.”

A few students stated that they would have liked to have the TtR2 all semester. For example, student S2-15B posited, “I think it's a good way to learn about the lessons. Maybe all students should do it all semester, instead of dividing it up. Then we can learn more for the whole semester versus just half.” Furthermore, two other students actually thanked their professor for using the TtR2 in their comments. The students stated: (a) [Professor's name], my comment about the ticket to retention- it helped me to understand better the subject and material during the class. It was like reinforcing while I was writing, reading, and talking to my peers. Thank you...” (S3-15B) and (b) “I think it was a great tool, and the results really gave me a lot to think about. Thank you for the invaluable tool and information. I really enjoyed this class” (S3-23B).

## **Discussion**

This study investigated the effectiveness of the TtR2, which is an attempt to incorporate addition aspects into CATs so that student retention of concepts results. The study represents the first time the combination of a pretest and posttest has been used to determine

the effectiveness of the TtR2. Previous research on the TtR (Divoll & Browning, 2010) tested the retention of students when they used the TtR and used a comparison group to determine if the TtR was effective (Divoll, Browning, & Vesey, 2012). Those studies indicated that students who used the TtR recalled approximately 88% of the information that was reviewed using the TtR (Divoll & Browning, 2010) and the results of the TtR seemed to be more effective for short answer questions than multiple choice questions (Divoll, Browning, & Vesey, 2012). We theorized that the TtR2 would result in higher averages than the TtR since the TtR2 was redesigned from its original version to include aspects of teaching adults that are deemed beneficial such as highlighting key points during instruction (Bransford et. al., 2000; Davis, 2009), incorporating higher level thinking skills, and providing feedback, practice, and review (Bransford et al., 2000; Davis, 2009; Donovan, et al., 1999).

### ***Summary of MRA and CRA Results***

The average for students across all three sections when tested on the information that was reinforced using the TtR2 on the MRA was 83.8%. This average was 15.8 points higher than their peers in group B. The 15.8 point difference was slightly higher than the 13 point difference between group A and group B observed in earlier research on the TtR (Divoll, Browning, & Vesey, 2012). While pleased that students in the current study in group A scored so much higher than group B, we expected more than a 2-3 point difference between results from the TtR2 and the TtR. However, not having a pretest in the previous study, students prior knowledge was not known before the semester began. The MRA scores with the TtR2 versus without the TtR2 for two of three sections were statistically significant. The third section was not statically significantly higher, meaning that the difference could have occurred by chance, but students with the TtR2 did average 15.1 points higher than group B. In addition, section three only had 8 students who used the TtR2 on the MRA and 9 who did not, thus the low numbers could have impacted the results of the Mann-Whitney *U*. These results indicate that the TtR2 was successful in producing higher class averages on short answer tests for students who used the TtR2. This data suggests that CATs can be adapted to improve students' concept retention, whereas previous research on the link between classroom assessment and learning was mixed (Anglo & Cross, 1993; Kelly, 1991; Olmstead, 1991; Shelton, 1991; Stetson, 1991; Walker, 1991).

When tested using multiple choice questions (CRA), the difference between information that was reviewed using the TtR2 and the information for which the TtR2 was not used resulted in a smaller increase, just under three points (85.7 to 82.8). The same results occurred in an earlier study on the TtR. However since the numbers were low in the previous study (i.e., 21 students), the assumption was that with the redesigned TtR and the increased numbers (i.e., 70 students) the results of the current study would be higher. In this study, the difference between the TtR2 results on the MRA and the CRA could result from one of five possible reasons: (a) the comparison of two groups who had different lengths of time between use of the TtR2 and the CRA, (b) the types of test questions (i.e., short answer versus multiple choice), (c) the possibility that students in one group had more prior knowledge of the content that was tested on the CRA, (d) the stu-

dents in groups A and B used the TtR2 for different concepts on which they were assessed on the CRA (i.e., questions 1-27 for group A and questions 23-49 for group B) and/or (e) the students in one group were better students.

One limitation of this study was that group A used the TtR2 on the first part of the semester (classes 2-7), while students in group B used the TtR2 weeks (7-9 and 11-13). Therefore, time between using the TtR2 and the CRA was longer for the students in group A than the students in group B. For example, the information for group A that was reviewed using the TtR2 was anywhere from four weeks (summer semester) to thirteen weeks (fall semester) prior to the CRA, while the information that was not reviewed using the TtR2 was anywhere from three days (summer semester) to seven weeks (fall semester). Thus, the only time the results were compared from the same time period with and without the intervention was on the MRA. The CRA compared different questions and length of time between the intervention and the assessment. This issue with the study design most likely contributed to discrepancy between the impact the TtR2 had on the CRA and MRA.

Another potential explanation for the vast difference for the result on the MRA and the CRA was the type of questions that were used on the MRA (short answer) versus the CRA (multiple choice). Students tend to score better on tests when there are answer choices from which to choose versus when they provide an answer (short answer) (Biggs, 1999; Carvalho, 2009; Dansereau, 1985; Gay, 1980; Nickerson, 1989). Some of the effects of the TtR2 could be negated on the CRA because multiple choice questions are easier to answer than short answer questions (Carvalho, 2009). If the TtR2 results in improved recall and automaticity of recalling information, as some students suggested, then having the answers provided through multiple choice items may reduce the effects. Our earlier research resulted in the TtR having a larger effect on the MRA than the CRA (Divoll, Browning, & Vesey, 2012). Thus, our current study was designed to determine what the students knew at the beginning of the semester (i.e., pretest) and to compare student scores to what they recalled on the MRA and CRA (i.e., change score) in hope that this question would be answered.

### ***Summary of Change Scores***

As mentioned above, the pretest helped highlight what students could recall from the beginning of the year to the MRA and CRA. Students in group A and group B across all of the sections averaged about the same going into the semester 64% (group A) to 64.2% (group B). The Mann-Whitney *U* test revealed that students in group A receiving the TtR2 during weeks 2 – 6 performed about the same on the pretest as students in group B. In addition, the pretest average for the information that was reviewed using the TtR2 was 66.2, while the information that was not reviewed using the TtR2 was 64.1. The Mann-Whitney *U* statistic that was run for all three classes indicated that there was no statistical difference between the students in group A and B in each class on questions 1-22 and questions 28-49 on the pretest. The possible conclusion for the discrepancy between the impact of the TtR2 on the MRA and CRA is that group A happened to be better students than group B or that they knew more coming into the semester does not seem to be plausible given the aforementioned data.

The change score from the pretest to the MRA for the group who had the TtR2 (group A) averaged 25.4 points, while students who did not use the TtR2 (group B) averaged a change score of 8.5 point (a difference of 17). The Mann-Whitney *U* revealed that the change scores for group A in two out of the three sections significantly differed, meaning that the intervention was most likely responsible for the difference in those classes. According to the Mann-Whitney *U*, the 15.1 difference between students who used the TtR2 and those who did not in section three, the class that were there was no significantly difference, could have resulted by chance. These results could have been influenced because of the now numbers (eight students in group A and nine in group B). The change scores between groups A and B on the MRA suggest that the TtR2 made a difference (significant difference for two out of three classes and a numerical difference for all three), especially since the pretest yielded no significant difference between groups A and B at the beginning of the semester.

The change score from the pretest to CRA across all three sections was 23.4 points when students used the TtR2, while students who did not use the TtR2 had a change score of 16.6 points. The Wilcoxon revealed that the change scores for group A in two out of the three sections did not significantly differ, meaning that the difference for the two classes was most likely caused by chance. Across all three sections, the students who used the TtR2 had a change score that was 6.8 points higher than their peers. Once again, it seems logical that the difference between the change scores on the MRA and CRA can be attributed to the study design (i.e., attempting to compare two groups who had a different length of time between the use of the TtR2 and the CRA and the students in groups A and B used the TtR2 for different concepts on which they were assessed on the CRA) and/or the type of questions on the CRA (multiple choice) (Biggs, 1999; Carvalho, 2009; Dansereau, 1985; Gay, 1980; Nickerson, 1989).

### ***Student Questionnaire Data***

The student questionnaire data provided the students' voice to the numerical data collected for the TtR2. It is interesting that 50% of the students surveyed suggested that they would use the TtR2 in their future classroom and another 35% suggested that they might use the TtR2 in their classroom. This indicates that 85% of the students recognize the value of the TtR2. Only 15% of the students suggested that they would not use the TtR2 in their future classrooms. Of that 15%, four of these 10 students suggested that they would not use the TtR2 because they were going to teach very young children. Thus, some of the students who suggested that they would not use the TtR2 in their future classroom still recognized the benefits of the TtR2, but felt young children, because of their limitations with reading and writing, would not benefit from the TtR2.

*Students' perception of the TtR2 on their learning.* Forty-three of the students (63.2%) stated that the TtR2 had a positive impact on their learning. Some students felt that the TtR2 resulted in recall that was more automatic, helped them recall more difficult information, improved their content vocabulary, and gave them confidence with the material, which are aspects that were not measured by the assessments.

Additionally, two students thanked their professor in their response to the questionnaire because they believed that the TtR2 helped them and one suggested that the TtR2 helped her as an English language learner. The TtR2 can be considered an effect strategy for English language learners because it includes: (a) one on one social interaction, (b) reviewing and rehearsal of concepts and vocabulary, (c) using multiple senses, (d) expanding content vocabulary, (e) practicing listening, speaking, and writing in a meaningful way, (f) clarifying concepts and helps students become confident with the content, and (g) using active engagement (Colombo, 2012; Echevarria & Graves, 2011; Echevarria, Vogt, & Short, 2008; Genesee, Lindholm-Leary, Saunders, & Christian, 2006; Ginsberg & Wlodkowski, 2009; Levine & McCloskey, 2009; Peregoy & Boyle, 2005; Smiley & Salsberry, 2007; Vogt & Echevarria, 2007). The students' comments along with the quantitative data above provide growing evidence that the TtR2 is effective and that CATs can be adapted to improve student retention. Even without the previously mentioned data that supports the TtR2, the fact that so many students believed that the TtR2 worked for them could result in a placebo effect wherein students are more confident and thus perform better.

Of the students who suggested that the TtR2 had little or no impact on their learning, five suggested that the professors' active learning strategies helped them just as much or more than using the TtR2. These comments also highlight another limitation of this study. This course, regardless of professor or semester, included many active learning activities to help students learn the course material. Thus, some of the recall that students had on the MRA and CRA could have been due to the active learning strategies since such strategies improve learning (Flint et al., 2002; Ginsberg & Wlodkowski, 2009; Grubb, 1999; Grubb & Byrd, 1999; Kuh et al, 2005; McGlynn, 2001; Meyers & Jones, 1993; Sorcinelli, 1991; Wlodkowski, 2008; Woolfolk, 2011). Consequently, the use of active learning strategies could have been part of the reason for the discrepancy between the results with the TtR2 and without the TtR2 on the MRA and CRA. It would be interesting to see how the TtR2 impacted retention in a predominately lecture class.

Five students also suggested that the TtR2 had little or no impact on them because they understand how to study and take notes, they are over achievers, and/or they were "genuinely interested in the topic." These students also suggested that the TtR2 should be used for students who do not have these skills or interest in the subject. The students raised an interesting point. Could part of the reason that the TtR2 was more effective for some students and not as effective for other students be a result of the students' abilities as learners, study time outside of class, learning style, and/or interest in the topic? Students who review the material on their own, as some students suggested, and take good notes might not need the TtR2 and for these students the TtR2 might not be as effective. Another issue mentioned by students was that the TtR2 was rushed at the end of class, often went past class time, and students not involved in the TtR2 that week could leave early. These aspects, as a student indicated, resulted in some students rushing to finish the TtR2 and potentially not being as invested in the process.

## Conclusion

CATs or other closure activities are widely promoted for use in college classrooms (Angelo & Cross, 1993; Barkley, 2010; Blumberg, 2009; Cross, 1998; Cross & Angelo, 1988; McGlynn, 2001; Nilson, 2010; Richlin, 1998; Richlin, 2006; Steadman & Svinicki, 1998; Weaver & Cotrell, 1985; Wlodkowski, 2008). However, research on whether CATs improve student learning are mixed (Anglo & Cross, 1993; Kelly, 1991; Olmstead, 1991; Shelton, 1991; Stetson, 1991; Walker, 1991) and therefore one can argue that the evidence that CATs improve learning is lacking (Simpson-Beck, 2011). The authors posit that the results are considered mixed or lacking because CATs were designed to "help teachers find out what students are learning in the classroom and how well students are learning it" (Anglo & Cross, 1993, p.4) rather than to help students learn the material. Thus, in order for CATs to be effective for helping students learn, they should be redesigned to focus on student retention of concepts. The TtR2 is designed to do just that.

The data reported indicate that the TtR2 is an effective method to assist students with the retention of concepts when tested using short answer questions. However, as was the case with earlier research, the results are reduced when students are retested using multiple choice questions (Divoll, Browning, & Vesey, 2012). The reduced effect of the TtR2 on multiple choice questions could have resulted because of aspects of the study design, the active learning strategies that were implemented in class, and the multiple choice questions that were used on the CRA. Despite these results, the fact that students score better on short answer questions (MRA) than multiple choice questions suggests that students who used the TtR2 are not only able to recall the answers, but are also have enough understanding to explain their answers in writing. In addition, the students' comments show that the TtR2 resulted in: remembering difficult concepts, more confidence with the concepts, quicker recall, learning vocabulary, taking notes for some students who do not normally take notes, and being more aware of the professor's key points. These are aspects that were not measured by the assessments.

Furthermore, when students' prior knowledge is included in the study, the data suggest that the TtR2 had a positive effect on the short answer questions. The change scores for students (i.e., the difference between the pretest and the MRA or CRA) who used the TtR2 on the MRA were 17 points higher than their peers, while students who used the TtR2 on the CRA scored 6.8 points higher. Thus, based on what students knew at the beginning of the semester, the students with the TtR2 were able to recall more than their peers. However, the Mann-Whitney U and the Wilcoxon revealed that the change scores on the MRA for students with the TtR2 and without were only significant for two out of the three courses and one out of the three courses on the CRA.

Although this data adds to the literature on CATs and the TtR2, further research is needed. Such investigations should include addressing the following questions: (a) Are the effects of the TtR2 more pronounced for students who have weak study skills; (b) Is the TtR2 a good strategy for English language learners at the college level; (c) How would the TtR2 perform if it was implemented in a lecture only class; and (d) Is the TtR2 only effective on short answer questions?

In addition, future research is needed that has students using and not using the TtR2 during the same weeks, and tests students in multiple types of questions. Given the impressive results of the TtR2 on the MRA, the limited results on the CRA, and the fact that almost 78% of the students believed the TtR2 helped their learning, the TtR2 shows potential for adapting CATs to improve student retention of concepts.

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